**NORMALIZATION :**

Normalization is a way to organize data in databases to avoid repeating information and improve data accuracy. Normalization also helps to organize the data in the database. It involves breaking down large tables into smaller ones. Normalization organizes the columns and tables of a database to ensure that database integrity constraints properly execute their dependencies. It is a systematic technique of decomposing tables to eliminate data redundancy (repetition) . So, SQL normalization serves the dual purpose of removing unnecessary (repetitive) data and ensuring logical data storage.

Consider an example of student database with attributes such as StudentID, Student Name, Course, Course Instructor, Course Department, and Department Location.

**First Normal Form(1NF) :**

This is the most basic level of normalization. In 1NF, each table cell should contain only a single value, and each column should have a unique name. The first normal form helps to eliminate duplicate data and simplify queries.

Example :

To achieve the first normal form (1NF), we split the table into two: one for student details and another for course details. This eliminates repeating groups and ensures each entry is atomic.

**Second Normal Form (2NF) :**

2NF eliminates redundant data by requiring that each non-key attribute be dependent on the primary key. This means that each column should be directly related to the primary key, and not to other columns.

Example:

For the second normal form (2NF), we identify and remove partial dependencies. We move the Course Instructor and Course Department attributes to a separate table, as they depend on the course rather than the entire primary key.

**Third Normal Form (3NF) :**

3NF builds on 2NF by requiring that all non-key attributes are independent of each other. This means that each column should be directly related to the primary key, and not to any other columns in the same table.

Example :

The third normal form (3NF) is achieved by eliminating transitive dependencies. We create a new table for departments and move the Department Location attribute there, ensuring that it depends only on the primary key of the department.